Claims

1. A repeater system (10) for receiving a modulated input signal and for transmitting a modulated output signal, comprising:

a clock oscillator (34) for providing a repeater system clock (f_{CLK});

a demodulator (12) for demodulating an input signal to obtain a demodulated signal, the input signal being the modulated input signal or a signal derived from the modulated input signal, the demodulator (12) including:

a first mixer (28) which is arranged for receiving the input signal:

a first controllable oscillator (30) connected to a local oscillator port (28c) of the first mixer (28), the first controllable oscillator (30) being arranged for providing an output signal which is derived from the repeater system clock (f_{CLK}):

feedback means (32) for determining a first control value (CV_1) applied to the controllable first oscillator (30), the control value (CV_1) being determined such that the frequency of a signal at the output port (28b) of the first mixer (28) approaches a desired value;

a modulator (14) for modulating the demodulated signal to obtain a modulated signal, the modulated signal being the modulated output signal or a signal from which the modulated output signal is derived, including:

a second mixer (38) which is arranged for receiving the demodulated signal at an input port (38a) and for providing the modulated output signal at an output

port (38b);

a second controllable oscillator (36) connected to the local oscillator port (38c) of the second mixer (38), the second controllable oscillator (36) being arranged for providing an output signal which is derived from the repeater system clock (f_{CLK}), the second oscillator (36) being controlled by a second control value (CV_2); and

a controller (40) for receiving the first control value (CV_1) and for providing the second control value (CV_2), the controller being arranged for determining the second control value (CV_2) on the basis of the first control value (CV_1) such that the frequency (f_{OUT}) of the modulated output signal approaches a predetermined value.

2. The repeater system of claim 1, which is arranged for receiving the modulated input signal, which frequency is higher than a demodulator (12) operating frequency, the repeater system (10) further comprising:

a tuner (18) for down-converting the modulated input signal to obtain a modulated intermediate frequency signal forming the demodulator (12) input signal, the tuner (18) being arranged for using a tuner oscillator signal, which is derived from the repeater system clock (f_{CLK}), and

wherein the controller (14) is arranged for determining the second control value (CV_2) further on the basis of the ratio of the modulated input signal frequency (f_{IN}) and the repeater system clock frequency (f_{CLK}).

3. The repeater system of claim 1 or claim 2, which is arranged for transmitting the modulated output signal, which frequency is higher than a modulator (14)

operating frequency, the repeater system (10) further comprising:

an up-converter (22) for up-converting the modulated signal to obtain the modulated output signal, the up-converter (22) using an converter oscillator signal which is derived from the repeater system clock (f_{CLK}), and

wherein the controller (40) is arranged for determining the second control value (CV_2) further on the basis of the ratio of the frequency (f_{OUT}) of the modulated output signal and the repeater system clock frequency (f_{CLK}).

4. The repeater system of any of the claims 1 to 3, further comprising an analog/digital converter (50) having its output connected to the demodulator (12) for providing digital demodulator input signal.

5. The repeater system of any one of the preceding claims, wherein the modulated signal has been modulated by a complex I/Q modulation technique.

6. The repeater system of claim 4 or claim 5, wherein the first and second controllable oscillators (30,36) are numerically controlled oscillators, each numerically controlled oscillator having:

a n-bit phase accumulator (60); and

a sine/cosine lookup table (62) for outputting a sine signal and a cosine signal, the frequencies thereof being determined by the first and second control values (CV_1,CV_2), respectively, each control value being determined by the ratio of a respective increment (I_Q,I_M) and a respective table length (T_Q,T_M) of the respective lookup tables (62).

7. The repeater system of claim 6, wherein the first mixer (28) is a complex multiplier receiving at its local oscillator port (28c) the sine signal and the cosine signal output by the first numerically controlled oscillator (30), and outputting at its output port a complex signal having an in phase component (I) and an quadrature component (Q).

8. The repeater system (10) of claim 6 or claim 7, further comprising a decision stage (52) arranged for receiving at an input port thereof the I/Q components and outputting at an output thereof phase values on the basis of the I and Q components, these phase values representing the demodulated signal.

9. The repeater system (10) of claim 8, wherein the feedback means (32) comprises:

a phase discriminator (32a) arranged for receiving, as actual values, the I and Q components and, as desired values, the phase values output by the decision stage, and for outputting a phase difference between the actual values and the desired values; and

a loop filter (32b) for receiving the phase difference and for outputting the increment (I_Q) for the first numerically controlled oscillator such that the output frequency of the numerically controlled oscillator equals the frequency of the modulator input signal.

10. The repeater system (10) of any one of the preceding claims, wherein the feedback means (32) is arranged to determine the first control value such that the desired value is zero.

11. The repeater system (10) of any one of the preceding claims, wherein the demodulator (12) has a specified

capture and tracking range and wherein the required accuracy of the clock oscillator (34) is determined by the specified capture and tracking range rather than by the required accuracy of the modulated output signal frequency (f_{OUT}) of the repeater system (10).

12. The repeater system (10) of claim 1, wherein the controller is arranged for implementing the following equation for obtaining the second control value (CV_2):

$$CV_2 = f_{OUT} \cdot CV_1/f_{IN}$$

wherein f_{OUT} represents the modulated output signal frequency, f_{IN} represents the modulated input signal, and CV_1 represents the first control value.

13. The repeater system (10) of claim 3 and claim 2, wherein the controller (40) is arranged for implementing the following equation for obtaining the second control value (CV_2):

$$CV_2 = f_{OUT}/f_{IN} \cdot (a + CV_1) - d$$

wherein f_{OUT} represents the modulated output signal frequency, f_{IN} represents the modulated input signal frequency, CV_1 represents the first control value, a represents a fixed ratio between the tuner oscillator frequency and the repeater system clock frequency, and d represents a fixed ratio between the modulated output signal frequency and a repeater system clock frequency.

14. The repeater system (10) of claim 7, wherein the table length of both numerically controlled oscillators (30,36) is 24 bits and wherein the multiplier (28) is a 10-bit multiplier.

15. The repeater system (10) of any of the preceding claims, which is adapted for receiving a satellite signal as the

modulated input signal, and for transmitting the modulated output signal into a terresterial single frequency network.

16. Method of receiving a modulated input signal and transmitting a modulated output signal, comprising the following steps:

providing a repeater system clock (f_{CLK});

demodulating the modulated input signal or a signal which is derived from the modulated input signal, to obtain a demodulated signal wherein the step of demodulating comprises the following substeps:

mixing (28) the modulated signal or the signal derived from the modulated signal using an oscillator signal output by a first controllable oscillator (30), which output signal is derived from the repeater system clock (f_{CLK}) to obtain a mixed signal;

determining (40) a first control value (CV_1) applied to the first controllable oscillator (30) such that the frequency of the mixed signal approaches a desired value;

modulating (14) the demodulated signal to obtain the modulated output signal or a signal from which the modulated output signal is derived, wherein the step of demodulating comprises the following substeps:

mixing (38) the demodulated signal or a signal which is derived from the demodulated signal using an oscillator signal output by a second controllable oscillator (36) which output signal is derived from the repeater system clock (f_{CLK});

determining (40) a second control value (CV_2), on the basis of the first control value (CV_1), such that the frequency of the demodulated output signal approaches a predetermined value; and

controlling the second controllable oscillator by applying the second control value (CV_2) to the second controllable oscillator (36).